

CLAIMS

1. A breathing assistance apparatus adapted to deliver humidified gases at a desired level of humidity or at a desired temperature to a patient comprising:
humidification means having an electrical input power and capable of humidifying
said gases up to a level of humidity prior to delivery to said patient, said level of humidity
depending on said input power to said humidification means,
transportation pathway means for conveying said humidified gases from said
humidification means to said patient, and
control means including stored instructions to:
- (a) determine a parameter relating to the flow rate of said gases through said apparatus;
 - (b) determine based on at least said parameter the required electrical power input to said humidification means to deliver said gases to said patient at a level of humidity or at a temperature substantially similar to said desired level of humidity or said desired temperature;
 - (c) supply as said input power to said humidification means a level of power substantially similar to said determined power input to said humidification means;
 - (d) continuously monitor said parameter or said variable, and when a change in said parameter or said variable is greater than a first threshold, indicating a change in the flow rate of said gases, said control means reverts to said instruction (a).
2. A breathing assistance apparatus as claimed in claim 1 wherein when a change in said parameter or said variable is greater than a second threshold indicating said control means reverts to instruction (b), said second threshold relating to a lesser change in the flow rate than said first threshold.
3. A breathing assistance apparatus as claimed in claims 1 or 2 wherein said breathing assistance apparatus further comprises:

pathway heating means having an electrical input power, and being associated with said transportation pathway means wherein the gases flowing through said transportation pathway means are heated either directly or indirectly by said pathway heating means whereby the level of heating depending on said input power to said pathway heating means;

5 an ambient temperature sensor providing an indication of the exterior temperature; and said instruction (b) further comprises determining based on at least said indication of the exterior temperature the required power input to said pathway heating means to deliver said gases to said patient at a level of humidity or at a temperature substantially similar to said desired level of humidity or said desired temperature;

10 and said instruction (c) further comprises supplying as said input power to said pathway heating means a level of power substantially similar to said determined power input to said pathway heating means.

15 and said instruction (d) further comprises supplying as said input power to said pathway heating means a level of power substantially similar to said determined power input to said pathway heating means.

20 4. A breathing assistance apparatus as claimed in any one of claims 1 to 3 wherein said first threshold relates to the rate of change of said parameter or said variable with respect to time, wherein when said rate of change is greater than said first threshold said control means reverts to said instruction (a).

25 5. A breathing assistance apparatus as claimed in any one of claims 1 to 4 wherein said rate of change or said change in said parameter of said variable indicates a decrease in flow said control means pauses for a first delay before said control means reverts to said instruction (a) and if said rate of change or said change indicates an increase in flow said control means pauses for a second delay before said control means reverts to said instruction (a), said second delay being longer than said first delay.

30 6. A breathing assistance apparatus as claimed in claim 3 wherein said control means monitors said input power supplied to said pathway heating means to provide an indication of the resistance or temperature of said pathway heating means.

7. A breathing assistance apparatus as claimed in any one of claims 1 to 6 wherein said indication of the temperature or resistance is used by said control means at least in said instruction (d) as said parameter relating to the flow rate of said gases.

5 8. A breathing assistance apparatus as claimed in claim 7 wherein said input power to said pathway heating means comprises a voltage signal and a current signal, and said indication of the temperature or resistance relates at least in part to said voltage signal and/or said current signal and said input power to said pathway heating means.

10 9. A breathing assistance apparatus as claimed in claim 8 wherein said humidification means comprises a humidification chamber adapted to receive a volume of water and water heating means to heat said water to produce water vapour within said chamber in use, said gases passing through said water vapour in said chamber thereby being humidified, said instruction (a) further comprising:

- 15 i) energising said water heating means to heat said water towards a first condition,
ii) continuously monitoring said parameter or a variable indicative of a property of said water heating means, until said variable or said parameter indicates that said water has substantially reached said first condition,
20 iii) determining said parameter based on at least said variable and said indication of the external temperature.

25 10. A breathing assistance apparatus as claimed in claim 3 wherein the determination of said power to said humidification means in said instruction (b) is also based on said indication of the external temperature.

11. A breathing assistance apparatus as claimed in any one of claims 1 to 10 wherein said breathing assistance apparatus further comprises a gases supply means adapted to supply gases to said humidification means at a required pressure and resulting flow rate.

- 5 12. A breathing assistance apparatus as claimed in claim 11 wherein said gases supply means provides an output signal representative the level of electrical output to said gases supply means, said signal being supplied to said control means from which the flow rate of said humidified gases is determined.
- 10 13. A breathing assistance apparatus as claimed in claims 11 or 12 wherein said gases supply means comprise a fan driven by a variable speed electric motor.
- 15 14. A breathing assistance apparatus as claimed in any one of claims 11 to 13 wherein said estimate of the flow rate of said humidified gases is based on the current drawn by said variable speed motor.
- 20 15. A breathing assistance apparatus as claimed in any one of claims 1 to 14 wherein said breathing assistance apparatus further comprises a gases flow rate sensor from which said estimate of the flow rate of said humidified gases is determined directly.
- 25 16. A breathing assistance apparatus as claimed in claim 9 wherein said humidification means further comprises:
chamber sensing means providing an indication of the temperature of said water heating means and providing an indication of the electrical power drawn by said water heating means,
wherein said variable is indicative of said indicator of the temperature of said water heating means or said indication of the power drawn by said water heating means.
- 30 17. A breathing assistance apparatus as claimed in claim 16 wherein said parameter at least in said instructions (a), (b) and (c) is defined as the value of said power drawn by said water heating means divided by said temperature of said water heating means.
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15 18. A breathing assistance apparatus substantially as herein described with reference to and as illustrated by at least one of the accompanying drawings.